

Aspects of the geometry and topology of hyperbolic manifolds

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This course will survey certain aspects of the geometry and topology of hyperbolic manifolds of finite volume. Topics to be covered include:

1. Definition and models of hyperbolic n -spaces, the groups of isometries of these spaces, and classification of isometries.
2. Basic structure theorems for finite volume hyperbolic manifolds; eg thick-thin decompositions, and the ends of finite volume hyperbolic manifolds.
3. Constructions of hyperbolic manifolds; both closed and finite volume in all dimensions. This will require a certain amount of arithmetic, but I will attempt to keep this to a minimum.
4. The residual properties of the fundamental groups of hyperbolic manifolds; eg Selberg's Lemma and LERF.
5. Brief discussion of complex and quaternionic hyperbolic manifolds.
6. Discussion of open problems about the geometry, topology and group theory of hyperbolic manifolds and their fundamental groups.

References

- [1] A. Borel, Compact Clifford-Klein forms of symmetric spaces, *Topology* **2** (1963), 111 – 122.
- [2] M. R. Bridson and A. Haefliger, *Metric Spaces of Non-positive Curvature*, Grundlehren der Mathematischen Wissenschaften **319**, Springer-Verlag 1999.
- [3] M. Gromov and I. Piatetski-Shapiro, Non-arithmetic groups in Lobachevsky spaces, *Publ. I.H.E.S.* **66** (1988), 93–103.
- [4] C. Maclachlan and A. W. Reid, *The Arithmetic of Hyperbolic 3-Manifolds*, Graduate Texts in Mathematics **219**, Springer-Verlag, 2003.
- [5] J. G. Ratcliffe, *Foundations of Hyperbolic Manifolds*, Graduate Texts in Mathematics **149**, Springer-Verlag, 1994.